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EXAMINER

IM, JUNGHWA M

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 05/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/972,855

Applicant(s)

SUGIZAKI, YOSHIAKI

Examiner

Junghwa M. Im

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-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 February 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 3,12,13 and 19-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 3,12,13 and 19-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 12, 13, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakui et al. (U.S. Pat. No. 6,239,495) in view of Iijima et al. (U.S. Pat. No. 5,729,435).

Regarding claim 3, Sakui et al. show in Fig. 1 a semiconductor device comprising;

a first semiconductor chip 1-2 where a semiconductor element 3 is formed;

a plurality of first connecting terminals 8 arranged on a semiconductor element formation surface side in the first semiconductor chip 1-2, and connected electrically to the semiconductor element 3;

conductive members 4 buried in a plurality of through holes 5 that go through the first semiconductor 1-2 coupled to the second 1-1 to n-th semiconductor chips (12-4 in Fig. 3);

second connecting terminals on the back of the first chip are shown at 8-1, 8-2, ... in Fig.3; and

the average density of arrangement of the one of the first connecting terminals and the second connecting terminals is lower than of another of the first connecting terminals and the second connecting terminals as shown in Fig. 3. Fig.3 shows that the number of the second connecting terminals (7 metal bumps; 8-1 through 8-7) is more than that of the first connecting terminals (five metal bumps) which are formed on the first surface of the chip 12-1.

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The chips are mounted on an assembly board (col. 5, lines 25-33 and col. 1 lines 62-63), therefore it is obvious that at least either the first connecting terminals or the second connecting terminals is coupled to an assembly board to have a proper electrical operation in devices.

Also see the respective portions of the specification such as col. 4, lines 60-66.

Sakui et al. do not explicitly show that one of the connecting terminals is facing to the assembly board. Iijima et al. show in Fig. 17 a flip-chip arrangement which conductive bumps 206 is facing the board 202. Also see Fig. 4 for a flip chip configuration. . It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Iijima et al. to the device of Sakui et al. to have a flip chip arrangement since a flip chip configuration provides a higher density and a better performance for a device circuit.

Regarding claim 12, Sakui et al. show in Fig. 1, the semiconductor further comprising a second semiconductor chip 1-1 stacked on the first semiconductor chip 1-2, wherein at least portion of the connecting terminals 8 arranged on a stacked surface between the first semiconductor chip 1-2 and the second semiconductor chip of the first connecting terminals and the second connecting terminals in the first semiconductor chip is coupled to the second semiconductor chip (col. 4, line 58- col. 5, line 12).

Regarding claim 13, Sakui et al. show in Fig. 3, the semiconductor further comprising a second to an n-th (wherein n is a positive integer of three or more) semiconductor chips stacked above first semiconductor chip, wherein at least portion of the connecting terminals arranged on a stacked surface between the first semiconductor chip and the second semiconductor chip of the first connecting terminals and the second connecting terminals in the first semiconductor chip is coupled to the second to n-th semiconductor chip.

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Regarding the specific connections between the chips, see the respective portions of the specification, for example, from col. 5, line 30 to col. 6, line 9.

Regarding claim 19, Sakui et al. show in Fig. 1 and Fig.3, the semiconductor wherein said at least portion of the plurality of connecting terminals comprising conductive bumps 8's.

Claims 3, 12, 13, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakui et al. in view of Komiyama (U.S. Pat. No. 6,424,050)

Regarding claim 3, Sakui et al. show in Fig. 1 a semiconductor device comprising;  
a first semiconductor chip 1-2 where a semiconductor element 3 is formed;  
a plurality of first connecting terminals 8 arranged on a semiconductor element formation surface side in the first semiconductor chip 1-2, and connected electrically to the semiconductor element 3;

conductive members 4 buried in a plurality of through holes 5 that go through the first semiconductor 1-2 coupled to the second 1-1 to n-th semiconductor chips (12-4 in Fig. 3);

second connecting terminals on the back of the first chip are shown at 8-1, 8-2, ... in Fig.3; and

the average density of arrangement of the one of the first connecting terminals and the second connecting terminals is lower than of another of the first connecting terminals and the second connecting terminals as shown in Fig. 3. Fig.3 shows that the number of the second connecting terminals (7 metal bumps; 8-1 through 8-7) is more than that of the first connecting terminals (5 metal bumps) which are formed on the first surface of the chip 12-1.

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Komiyama is further introduced to clearly show the density of the conductive bumps arrangement is different between the first connecting terminals 15 and the second connecting terminals 24, 49 of the first chip 1 in Fig. 4. Also note that the device of Komiyama is a flip chip configuration, therefore at least of the connecting terminals faces the assembly board. It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the teaching of Komiyama to have a different numbers of conductive bumps for two connecting terminals in a flip chip configuration in order to have more compact arrangement to reduce a device size.

The chips are mounted on an assembly board (col. 5, lines 25-33 and col. 1 lines 62-63), therefore it is obvious that at least either the first connecting terminals or the second connecting terminals is coupled to an assembly board to have a proper electrical operation in devices.

Also see the respective portions of the specification such as col. 4, lines 60-66.

Subject matters for claims 12-13 and 19 have been discussed above.

Claims 20 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakui et al. and Iijima et al. as applied to claim 3 above, and further in view of Hsuan et al. (U.S. Pat. No. 6,236,109).

Regarding claims 20 and 25, Sakui et al. show in Figures 1 and 3, a semiconductor device comprising;

a first semiconductor chip 1-2 where a semiconductor element 3 is formed;

a first connecting terminal 8 arranged on a semiconductor element formation 3 surface side in the first semiconductor chip 1-2, and connected electrically to the semiconductor element;

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a conductive member 4 buried in a through hole 5 that goes through the first semiconductor chip 1-2;

a second connecting terminal 8-1 arranged on a back surface side of the semiconductor element formation in the first semiconductor chip, and connected electrically to the semiconductor element via the conductive member 4 in 1-2;

a second semiconductor chip 1-1 stacked on the first semiconductor chip 1-2;

a third connecting terminal (a third bump on 12-2) arranged on a semiconductor element formation surface side in the second semiconductor chip 12-2;

wherein, one of the first connecting terminal and the second connecting terminal of the semiconductor chip is arranged at a position facing to the third connecting terminal of the second semiconductor chip, the first semiconductor chip and the second semiconductor chip are electrically coupled with each other through the facing connecting terminals (col. 4, line 58 – col. 5, line 12); and

the average density of arrangement of the one of the first connecting terminals and the second connecting terminals is lower than of another of the first connecting terminals and the second connecting terminals as shown in Fig. 3. Fig.3 shows that the numbers of the second connecting terminals (7 metal bumps; 8-1 through 8-7) are more than that of the first connecting terminals (5 metal bumps) which are formed on the first surface of the chip 12-1; and

one of the connecting terminals is facing the assembly board as taught in Iijima et al. and the motivation for combining teachings of Sakui et al. and Iijima et al. has stated above in claim 3.

Also note that one of the connecting terminals of Hsu faces the assembly board, too.

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a portion of either the first connecting terminals of the second connecting terminals is distributed and arranged in the center area of the semiconductor chip (a bump 8-4 of the first chip 12-1 in Fig. 3), and power supply ( $V_{ss}$ ) is to be applied.

Also note that one of the connecting terminals of Hsu faces the assembly board, too.

The chips are mounted on an assembly board (col. 5, lines 25-33 and col. 1 lines 62-63), therefore it is obvious that at least either the first connecting terminals or the second connecting terminals is coupled to an assembly board.

Also see the respective portions of the specification such as col. 4, lines 60-66.

Sakui et al and Iijima et al. do not disclose the limitation over the size of the first and second chips.

However, Hsuan et al. show in Fig. 6A a multi-chip packaging device wherein the second semiconductor chip is larger than the first semiconductor chip.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Hsuan et al. to the device of Sakui et al. and Iijima et al. to have a larger second chip connected to a smaller first chip since such an arrangement improves the effect of heat dissipation during installation, thus controlling the chip connection.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an



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international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 21-24 are rejected under 35 U.S.C. 102(e) as being anticipated by Sakui et al.

Regarding claim 21, Sakui et al. show in Fig. 1 a semiconductor device comprising;

a first semiconductor chip 1-2 where a semiconductor element 3 is formed;

a plurality of first connecting terminals 8 arranged on a semiconductor element formation surface side in the first semiconductor chip 1-2, and connected electrically to the semiconductor element 3;

conductive members 4 buried in a plurality of through holes 5 that go through the first semiconductor 1-2 coupled to the second 1-1 to n-th semiconductor chips (12-4 in Fig. 3);

second connecting terminals on the back of the first chip are shown at 8-1, 8-2, ... in Fig.3; and connected electrically to the semiconductor element via the conductive members,

wherein at least one of the connecting terminals is coupled to an assembly board as discussed in claim 3 above, and

a portion of either the first connecting terminals of the second connecting terminals is distributed and arranged in the center area of the semiconductor chip (a bump 8-4 of the first chip 12-1 in Fig. 3), and power supply ( $V_{ss}$ ) is to be applied.

Limitations regarding claims 22-24 have been discussed in claims 12-13 and 19 accordingly.

### ***Response to Arguments***

Applicant's arguments with respect to claims 3, 12-13 and 19 have been considered but are moot in view of the new ground(s) of rejection.

*Conclusion*

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (703) 305-3998. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

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jmi  
May 18, 2003

  
Sara Crane  
Primary Examiner